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Inspiring and cultivating science awareness in young audiences through dialogue and astronomy. Discussion of three experiences

Anne M. Dijkstra
University of Twente, Science Communication, the Netherlands
a.m.dijkstra@utwente.nl

Pedro Russo
Leiden University, Universe Awareness, the Netherlands
russo@strw.leidenuniv.nl

Gustavo Rojas
Universidade Federal de São Carlos, Brazil
gurojas@gmail.com

Abstract

Nowadays, science and technology and its applications impact our societies in various ways. Some of these applications are easily accepted, while other applications are disputed or even rejected. At the same time, increasingly, it is expected that people are able to deliberate the consequences of applications when accepting or rejecting applications. Therefore, communication about science and technology and its applications with various stakeholders, such as citizens, consumers or children, is considered necessary. One way to better understand the complex processes of acceptance and rejection in the science-society relationship, is by stimulating and analysing interests of young people, our future scientific citizens, in science and technology. In this paper, we describe three different experiences on science outreach with children and young people. First, UNAWE is a project that aims to engage and inspire young children in the

age group of 4 to 10 years old, especially the underprivileged by using astronomy as a tool. Second, experiences are described with astronomy popularization in Brazil. Videocasts and hands-on activities developed with children and teenagers in Sấo Paulo state in Brazil are given. Finally, experiences with children in Dutch Science Cafés, called Zabuki, are described. Learning from these experiences can enhance our understanding of the complex science-society relationship as well as the experiences can inspire our future scientific citizens (Millar & Osborne, 2000, Siune et al, 2009).

Introduction

According to Irwin (2001), the recent developments about the changing relationship between science, technology and society and the proposed communication and engagement approaches relate to the more general and new notion of scientific citizenship. Or, as Horst (2007: 151) has pointed out: 'The notion of scientific citizenship points to an increasing awareness of the intermingling between science and society. It implies not only that scientific knowledge is important for citizenship in contemporary society but also that citizens can lay a legitimate claim about accountability of scientific research'. In this paper we argue that informal learning experiences, can contribute to the development of scientific citizenship and will enable citizens to consider science and technology in a balanced way. Informal learning experiences are experiences where learning take place outside the school context, such as in museums, science centres or via radio, television or the Internet. These learning experiences, amongst others, are voluntary, support own interests and offer opportunities for new experiences (De Bakker & Land, forthcoming).

In this paper we describe three experiences where informal learning takes place. Each of the experiences aimed at inspiring science awareness and stimulating dialogue and participation. Key characteristics are given and success factors are identified.

UNAWE: Inspiring Every Child with Our Wonderful Cosmos. A Leiden University Educational Programme

In the White Paper on Science and Technology (Government of South Africa, 1996) it is stated that "Scientific endeavour is not purely utilitarian in its objectives and has important associated cultural and social values. […]. Not to offer "flagship sciences (such as astronomy) would be to take a negative view of our future - the view that we are a second class nation, chained forever to the treadmill of feeding and clothing ourselves."

In the project Universe Awareness the beauty and grandeur of the Universe is used to encourage young children, particularly those from an underprivileged background, to have an interest in science and technology and foster their sense of global citizenship from the earliest age. Until the advent of Universe Awareness (UNAWE), there were no large scale attempts to use astronomy as a tool for inspiring and educating young children.

The awe-inspiring Universe captures the imagination of children, making it a great stepping-stone to introduce youngsters to science and technology. Indeed, many scientists can trace their interest in science to a moment as a young child when they were first introduced to the wonders of the cosmos. Considering the vastness and beauty of the Universe and our place within it provides a special perspective that can help broaden the mind and stimulate a sense of global citizenship and tolerance.

Goals and successes

The UNAWE project aims at three goals. The first goal is to create an international network. Although UNAWE was founded only 8 years ago, it is already active in 57 countries and comprises a global network of over 1000 astronomers, teachers and other educators. The international network provides a platform for sharing ideas, best practices and resources between educators from around the world. The network will also be used to run ambitious global projects, with the aim of broadening children's horizons beyond their local area and to show them that they are part of a global community.

The second and particularly important goal of UNAWE is to provide training activities for teachers and other educators of young children. UNAWE aims to give teachers the confidence to introduce astronomy and other science topics in the classroom,

and to create innovative methods for engaging young children in astronomy. To achieve this goal, UNAWE organises teacher training workshops and advertises other relevant training opportunities on the UNAWE website.

Finally, a third goal is to develop educational resources. Learning should be exciting and fun – and this is never truer than when dealing with young children. UNAWE encourages learning through play and hands-on activities, such as the inflatable UNAWE Earthball, which has been immensely popular. UNAWE is currently developing new resources, including an astronomy news service for kids, called Space Scoop, which is produced in partnership with the European Southern Observatory. The idea behind Space Scoop is to share with children the excitement that the latest scientific discoveries bring, and to demonstrate that there is still much to learn about the Universe – research that they could contribute to in the future. Space Scoop is also great a resource for teachers, acting as a focus for a classroom discussion. Other educational materials will include illustrated hands-on games, adventure books and magazine features. All materials are available for free in the Resources section of this website (creative commons license) and you are free to adapt these to suit your requirements.

UNAWE is endorsed by UNESCO and the International Astronomical Union (IAU) and it is now an integral part of the IAU Strategic Plan 2010–2020, which is called Astronomy for the Developing World. This is an ambitious blueprint that aims to use astronomy to foster education and provide skills and competencies in science and technology throughout the world, particularly in developing countries. It's precursor, EU-UNAWE was an EU FP7 Coordination and Support Action. The action was in accordance with parliamentary amendment 898, which added €2M to the 2009 space budget of DG E & I for "*actions which will include activities in the framework of the International Year of Astronomy (IYA2009)"*.

The project built on a pre-existing global Universe Awareness (UNAWE) project by exploiting achievements of European and South African astronomy and space sciences; to inspire, excite and stimulate children at an age when their curiosity is high and their value systems are being formed and was implemented in five European countries (Germany, Italy, The Netherlands, Spain, and the UK) and South Africa.

The specific objectives of EU-UNAWE were to train and empower primary school teachers, to develop and translate innovative hands-on educational materials for young children, to provide a network for exchange of expertise and materials, to help stimulate production of the next generation of engineers and scientists, particularly girls, to contribute to the integration of underprivileged communities, and finally, to strengthen collaboration between Europe and South Africa across scientific, technological, educational and social topics. EU-UNAWE has accomplished all of these objectives. In 2011, the project was awarded the prestigious 2011 Science Magazine Science Prize for Online Resources in Education (SPORE).

Astronomy popularization in Brazil

The second experience is with astronomy popularization in Brazil. UFSCar is a federal university in São Carlos, Brazil, where several initiatives of astronomy popularization are under course. The objective is to widen the access to Astronomy knowledge among Middle and High School students and also offering teacher training. Besides hands-on activities developed with children and teenagers in São Paulo state. The project also produces a weekly videocast, "O Céu da Semana" (This Week's Sky), with information about the main celestial events of the week – and where to look at in order to see them. The conversation topic will focus on the reach of these activities and the making of "O Céu da Semana" and its receptivity among the public.

Engaging children in science and technology via Zabuki Science Cafés in the Netherlands

In science cafés, scientists, stakeholders and the public can meet in an informal setting and participate in discussions about science and technology (Dallas, 1999, 2006). Not only adults appreciate the science café initiatives worldwide. In the Netherlands, also children are enthusiastic about their own science café Zabuki (see www.zabuki.nl). In November 2008, organizers of the regular science café for adults in a Dutch town called Deventer started, on special request of one of the initiators' kids, a science café for children. They called it Zabuki (Dijkstra, Van Voorthuizen & Van Zijtveld, 2011). The first café, with about 70 kids attending, was a success and since then, each month, 9 times

per year, about 70 children visit the Zabuki cafés on Wednesday afternoons. In addition, once a year a two-day festival is organized in collaboration with the local teacher's training schools which attracted 800 children, last year. As in regular cafés, engaged volunteers, often parents and students, organize the cafés. The children deliver input for the themes. Recently, several other Zabuki's opened their doors and offer children once a month an inspiring afternoon where they experience science and technology.

Characteristics

The children's science café has many characteristics that are the same as for science cafés for adults. The Zabuki cafés are organized in various ways. A permanent group of volunteers prepare and organize the cafés, take care of the public relations and so forth, while a group of other volunteers – preferably parents to induce personal engagement – help on a (irregular) basis during the cafés only. Local companies are asked to offer materials and expertise on a voluntary basis.

For each café, a theme is worked out - in cooperation with an expert - in various topics and workshops. These are selected based on actual developments and input from the children. Themes are not restricted to science issues strictly, but they can offer broader perspectives on developments that affect the science-society relationship. A speaker is invited to give a short introduction or demonstration of maximum 20 minutes. One of the organisers and the speaker check the presentation to make sure it is lively and understandable for children, and to ensure there is sufficient time for questions. After the introduction, the children work in turns on the different distinguished topics and perform various tests or undergo experiences. This can be a mix of smaller and bigger workshops. For example, in a café on robotics in four smaller workshops children discussed the principle of programming a Lego robot and tried to let it work, the working of a sensor was experienced and explained, with a robot arm they tried to replace draughts. The kids pay a small amount of money for expenses and a drink. Groups exist of a maximum of 8 to 10 children, and a total of about 70 children can attend. At the end, the children have to deregister and they are handed over to their parents before they can leave.

The main group of attending children is between 8 and 10 years. About one third of the children are joining in for the first time. Girls and boys are equally represented.

Mostly, the cafés are highly valued which is indicated by the children's enthusiasm and speed the next café is fully booked. Ever since its start, the café has been overbooked. Other cafés are organized in similar ways.

Of course, children undergo learning experiences during the cafés. They learn by doing. They gain knowledge about topics they sometimes did not hear of, and learn about bacteria, molecules or black holes, but education is not a main goal. Rather, the cafés aim at offering a challenging, low key experience in a different, stimulating context. Thus, children can – voluntary, but on a regular basis – explore themes they would not necessarily investigate or discuss at school or at home. In addition, the cafés could be called a 'hands-on learning experience' not only for the children but also for the volunteers.

In sum, the cafés are received enthusiastic by the children as well as by other involved parties. And although, in a sense, doing tests in workshops and experiencing scientific themes is not new, aspects that make the cafés unique are the bottom-up organisation, the own contribution children have in bringing in themes, the broader societal questions that are asked and discussed, and the interest and engagement the café induces from other parties. In our eyes, this personal engagement from children, parents and other interested parties can help to place science and technology in a broader perspective within society, so often pleaded for nowadays.

Conclusion and discussion

In our paper, we described three experiences that aimed at inspiring science awareness for young children. The projects try to enhance informal learning by offering possibilities for children and young adults to come into contact with science and technology and, in addition, get acquainted with the complex processes that embed science and technology. Offering such activities can help to better consider pros and cons of science and reflect on more general aspects in the relationship between science and technology and society. Discussing science and technology issues at a young age might even contribute to the new scientific citizens of the future.

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